

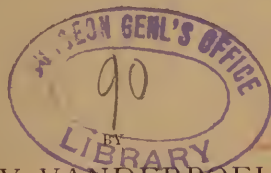
Vanderpoel (S.O.)

QUARANTINE;

GENERAL PRINCIPLES AFFECTING ITS ORGANIZATION.

*THE TRANSMISSIBILITY OF YELLOW FEVER AND
CHOLERA IN THEIR RELATION TO
QUARANTINE.*

(Read before the New York Academy of Medicine, and requested by The Medical Society of the State of New York for publication in its Transactions.)



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York Academy of Medicine, etc., etc.

ALBANY, N. Y.:
CHARLES VAN BENTHUYSEN & SONS,
1874.





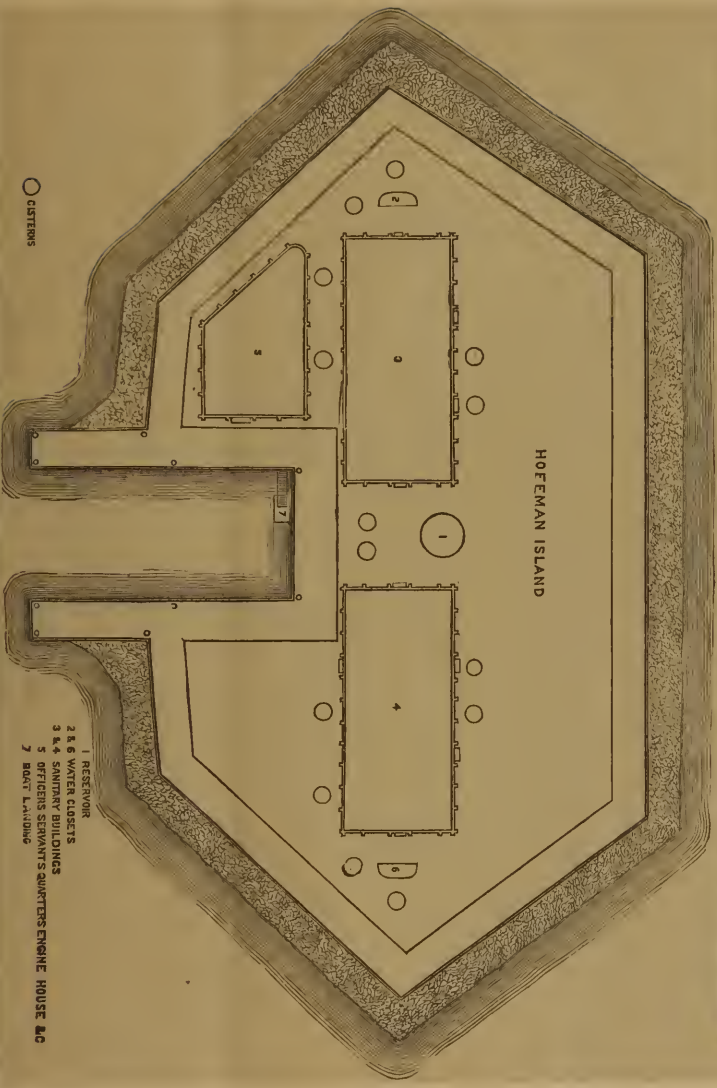
DIX ISLAND HOSPITAL.
STATEN ISLAND IN THE DISTANCE.

New Bedford Sea-Board, N.Y.

HOFFMAN ISLAND.



PERSPECTIVE VIEW
FROM THE
SOUTH WEST



○ CISTERNS

- 1 RESERVOIR
- 2 & 6 WATER CLOSETS
- 3 & 4 SANITARY BUILDINGS
- 5 OFFICERS' SERVANTS' QUARTERS ENGINE HOUSE & CO
- 7 BOLT LANDING

HOFFMAN ISLAND.

GENERAL PRINCIPLES
AFFECTING THE
ORGANIZATION OF QUARANTINE.

A PAPER READ BEFORE THE NEW YORK ACADEMY OF MEDICINE, IN
DECEMBER, 1873, AND, BY RESOLUTION OF THE MEDICAL
SOCIETY OF THE STATE OF NEW YORK, REQUESTED
FOR PUBLICATION IN ITS TRANSACTIONS.

BY

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ALBANY:
CHARLES VAN BENTHUYSEN & SONS,
PRINTERS, STEREOTYPERS AND BINDERS.
1874.

General Principles affecting the Organization of Quarantine ; a paper read before the New York Academy of Medicine, in December, 1873, and, by resolution of the Medical Society of the State of New York, requested for publication in its Transactions. By S. OAKLEY VANDERPOEL, M.D., Health Officer of the Port of New York.

The consideration of the subject of quarantine is based upon the notion that there is a class of blood-poisons which are *transmissible*. It is, I believe, admitted that there are those of a strictly endemic character, dependent upon local conditions, and, with the exception of typhus fever, rarely extending beyond the influence of those conditions. With this single exception they are not *contagious*, or, to use a more fashionable term, in the place of one which, since the days of Frascator, has done good service, and explained succinctly the idea intended to be conveyed, they are not *transmissible*.

There is, however, another class, which may be termed *exotic* in origin, and to prevent the importation or transmission of which, quarantine, in one form or another, was long since established. Limited both in number, and in the extent of territory in which they are indigenous, they assume a virulent and specific character, become transmissible to persons not exposed to the primary influence, and extend over vast portions of the inhabitable globe, and, after raging epidemically for a period, subside sometimes, it would seem, from mere lack of material for further ravages, or at another as if the primary germ-power had become exhausted. Coming as they do from localities outside of European or North American centers of population, their approach is always regarded with grave apprehension ; and from the earliest periods we find each country, each district, or it may be each municipality, devising restrictive measures to prevent their ingress. The plague, yellow fever, and cholera, are the three diseases included in the above description. From the first named this country has been wholly exempt ; yet from the fact that it has repeatedly been a fearful visitant over large portions of Europe, and that the restrictive measures adopted for its prevention, running through centuries, were the bases of all later ordinances to prevent the spread of yellow fever and cholera, I shall be compelled to refer constantly to them in the discussion of the question. Fortunately, in the organization of measures at this port, the traditions,

and oftentimes senseless regulations, which resulted from blind and fanatical populations in Europe, were not all-powerful to control their formation. Still the traditions of the past can everywhere be seen, sometimes affording valuable light to direct present operations, and sometimes, by an effort at blind uniformity and fixed regulations, presenting stumbling-blocks, which would be to the sanitarian so many causes of offense, and obstructions to all real progress.

I am aware that the subject is one rarely brought to the attention of a medical audience; yet if you recall for a moment that in its consideration are involved the most delicate questions which hygiene presents, that we must study the origin, progress, and methods of dissemination of contagious diseases, in order that we may intelligently limit them, you will see that it is intimately germane to all hygienic studies.

The name of *quarantine* is given to the measures of isolation imposed on persons and cargoes, susceptible, on account of their passage or their contact with persons or contaminated objects, of transmitting an epidemic or contagious disease of exotic production. Originally the word indicated the limit of time (forty days) that individuals suspected of exposure to pestilential contagion should be placed under observation. It no more expresses the duration of this trial; and now, in ordinary parlance, as well as special sanitary expression, the word *quarantine* expresses principally isolation and sequestration, without reference to the duration of the application of these measures—a duration which has varied so frequently according to the particular period, which varies still in different places, and which varies especially according to the nature and the different conditions of danger recognized in those exposed. It comprises, then, more specially, the whole series of restrictive measures destined to prevent the march of an epidemic or contagious affection. There are other measures, not strictly included in the above, which serve to complete this system, in acting not as barriers against the threatened scourge, but rather as modifiers of the particular district threatened, in which are involved all hygienic precautions. For the march of every affection transmissible by man is in reality subordinate to two conditions, each of which plays an important part: 1. The contagion, more or less intense, no matter what may be the vehicle. 2. Amount or degree of receptivity of the threatened population, of whom the immunities or morbid predispositions, sometimes inappreciable in their intimate cause, are, however, usually referable to the hygienic conditions of the population.

Since the end of the last century, however, we see observers of merit inveigh against the doctrine of contagion, and consequently the practical consequences thence arising. These would be the suppression of quarantines, the abolition of all impediments which might obstruct commerce, and the free circulation of travelers and merchandises. This is not, then, a discussion purely scientific, which amuses only cultivated intellects, having little practical results; on the contrary, an affirmative or negative solution would, on the one hand, paralyze all efforts, or, on the other, impress upon them a determinate course. For, if the origin of epidemics is to be ascribed to cosmic, telluric, or individual causes, over which we cannot hope to exercise any influence, we must be resigned to them, and support them with the same patience as we do the summer heats or wintry storms. This idea has its practical application in the respective measures taken by England and France with reference to the cattle-plague. Breaking out as it did about the same time in both countries, the resultant effect of different action is readily noted. The French veterinary officers, convinced of its contagious character, took immediately the most vigorous measures to strike at the root of the evil. It was necessary to slaughter promptly about a hundred animals to put a stop to the progress of the epidemic. In England, the anarchy of opinions, as well as imperfect legislation, allowed things to follow their natural course. The result was, that three hundred thousand animals died from the disease.

It is, then, of the highest importance to have decided opinions upon the subject: to wait until an epidemic is upon us, is to wait for precautionary measures after our building has been fired. Individual facts have more than once shown that the arrival of a single sick person in a locality, up to that time intact, has developed the epidemic. It is the initial case in which lies the chief danger; nor can I recall a better illustration of this than the facts presented by Dr. Peters in his researches upon the cholera in Lexington, Kentucky, during the past summer. Thirteen deaths occurred, before that of the initial case, every one of which was traceable to causes emanating from that case. I may mention here as at least a recognized fact, that all epidemics follow the routes, and with the same celerity as those who travel upon them.

On these points it will at least be found that clinical observation, international hygiene, and direct experiment, are in full accord with the teachings of traditional medicine.

With this preliminary statement, I proceed to a more systematic discussion of the subject.

1. All restrictive measures, isolation, quarantine, or, as practised in parts of Europe, the "cordon sanitaire," have exclusively as their purpose, often indeed at the expense of human liberty, to trammel the propagation of the morbid cause. Local hygienic measures are intended to render a district, so to speak, refractory to the action of this cause, by not presenting the materials favorable to such propagation. Unfortunately, these two courses have been, on the part of some, considered as two distinct methods, antagonistic the one to the other. The first, that is, restriction, has been extolled beyond measure by the contagionists, as sufficient. They only see, in every epidemic propagation, a series of morbid acts, fatally imposed on many similar organisms by the contact of a specific germ. The second, the pure hygienist, is the device of the partisans of morbid spontaneity, of the anti-contagionists, who, not content to recognize the enormous influence which the local conditions possess upon the germ, forget that we often see epidemics propagated in most salubrious localities, and consequently that we must oppose to transmissible affections other obstacles than those ordinarily included in mere hygienic principles, which alone can never confer upon the masses of a population an immunity comparable to that of lessening or rather excluding the cause. Each system errs in creating an exclusivism, because first, the method of absolute restrictions is contrary to the dignity of man, by the frequency and the abuse of the sequestration which it imposes. It is contrary also to the well-being and health of a people, in neglecting to guard against the dangers which arise from the collections of filth, the true local nests of every infection. Yet to-day we see this exemplified in all the Spanish, Italian, and many Eastern ports, where it constitutes the only safeguard in times of great epidemics. We know full well that, in most of these countries, the moral wretchedness of the people equals their physical, that above all else they are blindly superstitious, and attach themselves to measures of quarantine sequestration with the fanaticism of all their other beliefs, and are ready at the first indication to sustain them by the most violent and blinded acts.

2. The method of local prevention by rendering healthy the threatened locality, in ameliorating all the social conditions of the inhabitants, is, in itself alone, more specially adopted by a civilized people. It has this immense advantage, of inaugurating and estab-

lishing for a community an era of comfort and prosperity. You are all aware how much England owes to her immense works, undertaken, upon hygienic bases, within the past ten years. Thanks to these labors—thanks, also, to her natural isolation from the Continental masses ; still more, thanks to certain climatic conditions—Great Britain can, with impunity, maintain the free *pratique* of her ports. To attribute her immunity against different pestilential diseases to the happy effects of hygienic measures, is to encourage every nation or community with whom the principles of hygiene have not yet become practical ; but, in so doing, only one of the reasons of this immunity is recognized : the importance of climatic and topographic influences upon the march of epidemics is forgotten. In France, where public hygiene has made great progress—in this country, which will soon surpass, in this respect, the civilized world—owing to the special conditions of geography and climate, it is necessary to adopt, against the propagation of epidemics, a more complete system of prevention. They must first obstruct, by restrictive measures, the propagation of the morbid germ ; and, secondly, render, as far as possible, each locality refractory to its development. In both France and this country we have the daily proof that the two methods, in place of mutual exclusion, should be combined, in order to unite the double base of international and municipal prevention. So far from opposing each other, these methods mutually complete a system ; and now, at this port, the system of quarantine embraces the whole series of prophylactic measures opposed to the propagation of epidemic diseases, it matters not whether the measures have for object the opposing of the transmission of the morbid germ, or whether only to hinder its development by hygienic labors. From this happy accord results a sanitary *régime* more complete and more rational, and where we can, according to circumstances, apply the one or the other element. Quarantine restrictions, so senseless and imperfect heretofore, have drawn from prophylactic hygiene the fundamental principles of their actual working.

The truth is, the question of quarantines is one of the most complex of hygiene and medicine. If you bear in mind the obscurity which still hangs over the conditions of the development of epidemics ; if you recall that, upon the globe, there is not a continent—that, on such continent, there is not a country—which does not present different conditions of predisposition, or immunity, with reference to these scourges ; if, further, it is remembered that every

quarantine system, while it confers advantages upon those it protects, involves grave prejudices for those it contravenes, you will understand how difficult it is to express, in determinate administrative formulas, regulations applicable to every place. The joint responsibility so necessary among localities, since the most rational or the most absolute measures undertaken in one country can be annulled in their results by the indifference of another, will, for a long time, be difficult to obtain. To be scientific and practical, they should necessarily arrive at conclusions variable according to the locality or port to which the regulations are to be applied; variable, also, according to the nature of the diseases they propose to contravene. These regulations will then, by their diversity, recall how varied are the dangers they should prevent, and also how different is the morbid receptivity of the different populations which they are to protect. It is not difficult, then, to comprehend how essential it is that the great question of sanitary measures should become more and more the privilege of competent men—of men who understand the mode of propagation of epidemics, the local and geographical conditions of their development, and the special prophylactic measures applicable to each.

Rules established by tradition and custom have, without doubt, thanks to their uniformity, great facility in their practical application. But always to impose the same rules, in the most diverse conditions of time and place, as well as the nature of the epidemic designed to arrest, would be to act contrary to all our scientific data. Too long has this reform been retarded by the traditional errors drawn from European regulations, and we have, in this country, the opportunity to disembarass ourselves from a host of practices inspired by secular prejudices common in Europe.

While, then, true prudence should cause us to abstain from bringing the same regulations to the prevention of all pestilential diseases, the forms and modes of propagation of which vary so wholly, according to the places in which they are observed, we are not so embarrassed in determining the nature of the establishment required. Sanitary establishments have to-day their types, indicated by physicians and hygienists—types which can be reproduced and, as occasion requires, perfected. Not so, however, the regulations. You cannot give to all ports the same mode of application. In one city there may be topographical or social conditions which modify the degree of morbid susceptibility in the different classes of the popu-

lation. In fine, no absolute, no arbitrary rules can be formed, suitable for every latitude, every clime, or every people.

There is still another class of influences, irrespective of locality and the different forms of the pestilential diseases. They are the particular features of the epidemic itself, so variable at each explosion. When, for instance, we see one of these affections cover, so to speak, the entire world in its manifestations, or, at another time, as a circumscribed epidemic—when, in following out their history through a course of centuries, we see, at one time, the plague, at another, cholera, or, again, yellow fever, play successively the principal part in the scourges which decimate populations—we are certainly compelled to recognize the variability of the conditions of development of epidemic diseases, and consequently the inequality in the character of the protective measures.

It seems to me, you will best appreciate the different bearings of this subject by tracing, for a few moments, the origin and progress of the principle I have stated, and which controls the administration of this branch of sanitary science. The idea of the transmission of diseases by contact is one which dates back to the farthest antiquity. The minute prescriptions by which Moses sought to isolate, even in the midst of his camp, those attacked with leprosy, or other diseases which he supposed contagious, would indicate that already, with the ancient Egyptians, this first notion had been universally accepted.

Still, the first account we have of an epidemic propagated from *contagion* is not by a physician, but by the historian Thucydides. The plague at Athens is the first known of these formidable affections which, coming from without, fall suddenly upon an entire population, snatching innumerable victims. In the march of this epidemic we find the principal characters which at different times have been met in all subsequent incursions. Overcrowding, wretchedness, hunger, were shown among the predisposing causes, and which ever since have been known to favor the development of these fearful scourges. The fact, too, was established, that its way of entry was by the *sea*, the chief route for epidemics to enter a country.

It was not, however, until the appearance of the plague in 1348–'50, that the *régime* of quarantine against pestilential affections was fully inaugurated. As for ages previous leprosy had been the principal disease in which isolation was ordered, we see, in looking over the regulations which existed in many of the places on the shores

of the Mediterranean, that they were those adopted with regard to leprosy, save that the definitive isolation of the one was changed to the temporary sequestration of the other. About this period the recurrence of grave pestilential epidemics inspired the public, rather than physicians, with the notion of their transmissibility by those attacked. As a consequence the restrictions were marked by the brutal and superstitious spirit which characterized the age. The murdering of physicians, the bloody persecutions against the Jews, self-imposed tortures by individuals to propitiate Divine mercy, witness the superstition and barbarity of the epoch.

Soon it was noticed that vessels and passengers coming from the East, though not attacked themselves, brought with them the morbid germ. Venice, rising from her lagoons, was then the most enterprising and chief commercial city of the world. Covering the Mediterranean with her vessels, she made at the same time commerce and war; consequently her port more than any other was subject not only to the black plague, but especially the Egyptian, then so frequent in its explosions. Induced by their frequent appearance, she proscribed the sale and destroyed the effects of those who had died. She created three protectors of the health, a health bureau, and finally a lazaretto, which subsequently formed the model for all other ports.

Her example was followed by all the smaller places on the Adriatic coasts, existing then as separate governments. It is probable that the terror inspired by the repeated visitations of the pestilence gave rise to that persistent hostility to strangers which still exists in many portions of Southern Italy. From this time, too, dates the period of *forty* days as necessary for the examination of suspected persons. Another fact of interest in this connection is, that for the *first* time medical men, not only by the aid of scholastic arguments, but by the study of facts, interested themselves in the question, "how far contagion was concerned in the transmission of the plague"—as the result of these inquiries, running, it is true, through a long series of years, for after the disappearance of each scourge [precautionary measures were laid aside, to reappear more absolute at the approach of new danger.

About the middle of the sixteenth century, the celebrated work of Frascator appeared. It is the first work which speaks of contagion as now understood. According to him, a specific virus rises by exhalation from the body of the sick, extends but a short distance, attaches itself to certain substances, which thus become contaminated; this contamination remains, and may be transported unknown distances,

and infect entire communities. He recognizes also that certain other substances would not be contaminated. The public mind seized eagerly upon this distinction of contamination and non-contamination, the decision of which has been the source of so many discussions and such diversity of opinions. Independent of his natural exaggerations, his work wrought this double advantage: 1. To show certain real dangers not before suspected, and recall to rational observation many minds, misled by the belief in the influence of the stars, or by their faith in the Galenist dogma of occult causes. 2. To dispel, on the other hand, that which was equally difficult, certain prejudices which exaggerated the property of transmission of such diseases and admitted that they could be communicated by voice and expression of the sick. This opinion was still more fortified by a subsequent work by Masaria, who showed the immunity of persons who, during an epidemic, had remained shut up in their chateaux or in monasteries. He limited the ravages, in isolating the sick outside the city. The success which followed this advice made his work an article of faith, and it was followed by the organization of similar establishments in all Mediterranean ports.

From the beginning of the seventeenth century, Europe found herself, relative to the plague, in analogous conditions to those in which we are relative to cholera. The disease had reached its maximum of diffusion through the civilized world, and was especially terrible in all the large capitals. Sanitary police were established in all or nearly all, and the most vigorous measures were adopted for the sequestration of those stricken. Both local and general authorities acted in concord, the one in defining the movements and restrictions of the inhabitants; the other in surrounding the pested city with troops, to prevent ingress or egress except under definite regulations. The spirit of isolation was carried to such extremes that without doubt the scourge was intensified, by compelling the inhabitants to remain in the infected districts, and often by the inadequate supply of food to those so subjected. Fumigations were also liberally practised in all suspected localities, and also by physicians in making professional visits, but the articles employed were more marked by the pungency or specialty of odor than by any true disinfecting property.

The eighteenth century was marked by the more decided use of lazarettos. The result was soon observed; the disease declined from the interior portions of Europe, and was chiefly confined to the maritime ports. The regulations assumed a more explicit and in some

sense rational form, though the penalties were very severe, and enforced with intense rigor. Explicit directions were given to all vessels trading with Egypt or the Levant, not with reference to passengers only, but also the cargo and the vessel itself. The increasing commerce of France with the East gave the port of Marseilles an especial prominence, and its lazaretto became the most celebrated in Europe, not only in the care manifested, but, as knowledge existed, the best conducted. It enjoyed, too, the confidence of the citizens, by several times restraining the contagion from the city after its entrance into the lazaretto.

To one familiar with the history of the subject, it is interesting to study the minute distinctions made not only with reference to the bill of health, but the measures of observation taken with reference to passengers and merchandise—measures which, while they might protect the community, lost sight entirely of the rights and privileges of those suspected; and which, were there the least trace of fomites in the vessel or cargo, would be certain to communicate to the poor unfortunates, who were compelled to undergo an almost unlimited period of observation. During the latter part of this century, observations were more carefully and systematically instituted, and the modes of propagation of the scourge more accurately noted. Chief among these, was the great philanthropist, John Howard. He visited successively the hospitals and lazarettos of the Mediterranean, where the plague prevailed; attacked energetically the defective appointments, established the importance of the hygienic conditions in these establishments, sustained the inutility of quarantines imposed on merchandise, and really laid the foundation for the present English legislation on the subject. He dispelled the idea that the corpse could communicate the disease; a point of great importance, since in many epidemics they were allowed to accumulate unburied, people flying from them in terror. He combated, also, the foolish and grotesque precautions taken by physicians and nurses to escape immediate contact with the sick, and dispelled the illusion that the contagion could be conveyed by their breath.

During the early part of the present century, the doctrine of quarantine was affirmed with renewed energy, and the privileges accorded were, if possible, more decided; gradually, a more exact appreciation of facts induced a more eclectic tendency, preserving that which was useful, and rejecting that which was exaggerated. We notice, too, in European governments the first steps taken to stifle pestilential maladies in their place of origin, which resulted in the

international congress to consult upon the principles to be laid down in order to prevent their wide-spread diffusion.

An additional interest arises in their study, from the modification of the list of diseases to which restrictive measures should be applied. Up to the commencement of this century, no other disease than the plague had occupied the attention of quarantines. From 1821, however, the interest in this disease gradually subsided, to be replaced, in a far greater degree, by the questions of yellow fever and cholera. During the few years previous to this the anti-contagionists had inveighed severely against all restrictive measures in yellow fever, asserting that it could not be imported, and that those who thus affirmed were men without experience, obstinate, and of limited information. Scarcely had these positive opinions been enunciated, and even obtained some credence in public sentiment, when the terrible scourge of yellow fever, which invaded Barcelona in 1821, appeared. Its transmission by sea was undeniable; reaching the quarantine of Marseilles, it was excluded from that city.

For the cholera, a different order of circumstances presented. The danger to be apprehended here was not from the side of the sea, but from the land. For years European governments had watched the progress of the Indian scourge, the terror inspired by its ravages in Asia, and had hoped to arrest its progress on the Russian frontier. It was thought that, by creating a "*cordon sanitaire*" on the boundaries of each country, its progress could be arrested. Various restrictions to intercourse were established, virtually establishing quarantines by land as well as by sea. We all know how useless were these efforts. The rapid march of the first cholera epidemic through Europe in 1831, and the fact that it did not appear in certain countries where no restrictive measures were applied, showed the utter uselessness of these *cordons sanitaires* in thickly settled districts, and they were soon abandoned. It had the effect to revive the old discussions relative to its transmissibility from man to man, many asserting that it was wholly epidemic in its character, an argument which had a specious force from the rapidity and uncontrollability of its progress. Its contagion was treated by them as a chimerical belief; those who opposed the idea of contagion were considered truly men of progress, since they opposed restrictions to personal liberty, and their views were applied, not only to cholera, but typhus and other diseases. These hesitations and differences continue more or less still among the different portions of Europe. Indeed, the futility of the effort to establish a uniform system of

quarantine regulations for countries or seaports in different localities, having different relations with countries from which malignant diseases are brought, is acknowledged there—that which experience had long ago taught in this country.

Matters remained very much in this unsettled state, both as to the principles which should govern the administration of quarantines, and the varied action of different governments, when, in 1850, a convention, with reference to some uniformity of principle, was held at Paris.

It consisted of representatives from all principal European powers. They were medical men, and with them were associated also the consuls of the respective countries represented in France. Discussions of a purely scientific character were ignored; confining themselves to facts generally accepted, and by the aid of mutual concessions, they arrived at a code of international sanitary regulations, which, though since modified in many particulars, have remained the basis of all subsequent quarantine legislation. Among them I find many of the provisions of the law now in force in this state. I cannot enter into an analysis of its provisions, but whoever reads it carefully will see that it is based upon a study of the cause and progress of the diseases which it is intended to intercept, and, almost for the first time, places the administration of these establishments in the hands of medical men. It is not inappropriate to quote an extract from a paper by the Minister of Agriculture and Commerce, written just before this convention. He writes: "The question of quarantine is one of those questions of public hygiene which the government cannot decide, and which can only be resolved, either by the Academy of Medicine, or the Academy of Sciences."

The spirit inspired by this convention awakened a new interest and enthusiasm on the subject, and was the initiation for the subsequent gathering at Constantinople some fifteen years later. An energetic impulse was given, not only to the study of restrictive measures, but the still more important duty, the application of public hygiene to the prevention of epidemics, if possible, at the source—to stifle them in their exotic cradles, or at home, in removing the causes by which they are propagated, thus each diminishing the zones over which they can spread.

In looking over quarantine legislation as enacted at different times in this State, we are first struck with the freedom from the trammels and prejudices and formalities which so long marked all European

enactments. Each principle seemed to spring from the practical necessity of the occasion, and was generally the result of the experience afforded by some epidemic of fever just passed.

The first legislation was in 1784, and compares most favorably with contemporaneous European enactments. Yellow fever was then a frequent visitant of this port, appearing as an epidemic nearly every year during the latter part of the last and the early years of the present century. Another principle, as the result of these repeated epidemics, was early established, viz. : that all vessels from foreign ports, and all coasting-vessels, coming from south of Cape May at certain seasons of the year, should undergo sanitary inspection on entering the port. The futility of locking the door after the article is stolen was applied to quarantine, in the comparative uselessness of restrictive measures after an epidemic had gained foothold in the city. The great mistake was, that in protecting the community they lost sight wholly of the commercial interests involved. True, with navigation at that time wholly in sailing-vessels, *time* was not as important a factor as since the introduction of steam, and vessels and owners submitted most patiently to the restrictions. It is evident, however, that the natural history of the disease (yellow fever) was not fully understood, or we should have no such clause as this : "Vessels to be detained thirty days at quarantine, and twenty days after discharge of cargo. Cargoes to be detained subject to the decision of the health-officer. Crews and passengers to be detained twenty days after the last case of yellow fever, or twenty days after sailing from an infected port." What would become of West India trade if such orders were now enforced ? Yet a provision, containing almost similar regulations, stands now in force upon the statute-book. The whole tenor, however, of legislation has been to recognize the opinions and decisions of medical men in the quarantine enactments ; and, as a rule, they reflect the current opinions of the mode of dissemination of the epidemics they were intended to contravene. It is not necessary in this connection to recount the present practice with regard to pestilential diseases. I need only say in passing, that, as now constituted, the establishment is most complete in all its appointments, and fully equal to the sanitary requirements of the times. For the present there are still a few general considerations connected with the subject to notice before proceeding to the study of the special diseases.

We are now prepared, after a very hasty historical sketch of the origin and growth of the systems of quarantine, to consider their

prophylactic value. I am aware of the varied opinions which exist on this point, both in this country and in Europe, of partisans who on the one hand deny all sanitary value to their restrictions, and on the other, who claim for them exaggerated benefits. On looking closer at the school which opposes all sequestration, I find, almost invariably, that their opinions are formed and based by the surroundings and climate of their *particular localities*—surroundings where, from the nature of their position to neighboring countries, no restrictive measures, save those which could be effected by a *cordon sanitaire* (a system found totally inefficient in thickly-populated countries, and only applicable in sparsely-settled districts), could be applied ; and, on the other hand, countries situated in latitudes where the exotic pestilences, all of which find their endemic dwelling in the torrid zone, can, with the exception of cholera, find but a short season when temperature and hygrometric conditions would favor their development.

Such persons, studying alone from their own stand-point, attempt to apply general principles for all localities : a fallacy too absurd for contradiction. Quarantines are not essential to the higher regions of the temperate zone, nor to the localities in the torrid, where climate and temperature readily make yellow fever and cholera endemic. Strange as it may seem, there are still partisans who have their objections, upon the blind belief that there is a mysterious, intangible principle in the propagation of epidemics, and so deny the benefits of preventive measures.

The question naturally arises, in how far sequestration is advisable against exotic contagious diseases.

I. This sequestration is only advisable in localities where a general supervision of the arrival of such diseases is *easily made*, and which are separated, so to speak, by a natural zone of isolation from suspected districts. Such are localities on islands or cities, where the entrance of the disease would be almost wholly by sea. In such places the necessary *régime* is easy of application. This is shown by the almost total immunity which this city enjoys from yellow fever, for not a season passes, but numerous cases are taken off of vessels and detained in the quarantine hospital. During the cholera of 1865, many islands of the Mediterranean enjoyed an entire immunity from the disease. On the other hand, where topographical conditions are less favorable, this isolation from contagious diseases is almost impossible, and consequently it is illogical to impose such conditions upon them.

Still another series of conditions would modify the application of

these measures. Such are countries situated in the endemic zone of the disease which it is desired to restrain. Before deciding, then, upon its application for any given locality, we must determine whether it does not already exist there ; it may be in complete evolution, or as a localized germ. To apply restrictive measures without first determining these facts, is to establish useless barriers, and renew under another form one of the principal abuses of the old system. The limits of this zone of endemicity are often difficult to decide, still a solution so far as yellow fever is concerned has been reached. The establishment of quarantines along our southern seaboard has shown that its endemicity scarcely reaches our shores : in other words, that, with the exception of a *small portion* of our southern coast, the disease is *exotic*. Still another set of conditions neutralizes the benefit of restrictive measures. Certain countries are too distant from the seats of pestilence, or enjoy climatic conditions so peculiar, that these affections rarely find a lodgment. Take, for example, England : for the past two centuries her ports, relatively to the other ports of Europe, offer a remarkable immunity, when we take into account the extent of her commercial relations, against pestilential diseases. Shall we, then, say that the system of free *pratique*, which prevails in England, should be employed on the Continent ? Her immunity from yellow fever is the natural condition of her climate : this, while severe on the coasts of Spain and Portugal, is naturally mitigated as we ascend the Atlantic coast, until in England it finds a temperature wholly unsuited to its development. The same argument applies to the cities farther north than this on this coast. Again, yellow fever seems to require a certain density of population, seldom appearing in places where the population falls much below five thousand. It is readily seen that few of these objections to the establishment of quarantine observations apply to the cities of the Atlantic coast. Situate in the *exotic zone*, we know how useful restrictive measures have been during this century, in suppressing contagions almost entirely from the centres of population. True, much of this has been done in disregard of all consideration for the persons, the cargoes, or the vessels sequestered, and been the occasion of bitter conflicts between the sanitary and commercial interests ; but, since a better appreciation of the origin and progress of pestilential disease has been determined, it seems such interests are in no manner antagonistic, but, rather, that the prosperity of commercial interests is inseparably connected with a healthy condi-

tion of the port, and that this can be maintained without contravening their interest or prosperity.

Shall we, then, in the presence of such marked differences, arising from topographical conditions, proclaim the complete inutility of quarantines, even in localities in which, at the moment of danger, every avenue cannot be guarded? The transmission of epidemics through channels of human communications, is too capricious to guard every avenue and manner of contact. All know, however, the special susceptibility of seaports, the guarding of which should be one of the principal pre-occupations of the sanitary authorities in time of epidemic. If we cannot absolutely stop every method of penetration, we diminish, to a great degree, the chances, and preserve intact our commercial centre.

The port of New York, regarded in this aspect, presents peculiarities which require a moment's consideration, not with reference to her position to the yellow-fever zone, from which, since the use of steam-transit, the passage is made within the period of incubation of that disease, and where, without a supervising control, the infection is liable, during certain months of the year, to be brought into the city, but rather to the peculiar feature presented by the *emigration* to this port. Nearly four hundred thousand persons, cabin and steerage, enter annually, not from a single port, or the inhabitants of a particular nationality, but from every country and every principal seaport of Europe. It is thus, in an especial manner, liable to the incursion of epidemics raging in any portion of Europe, and experience has shown that their influence is carried hither even easier than to England. A large emigration of Poles, Finns, and Wallachians is taking place, and, as they come from the direct neighborhood where cholera enters Europe, and where it has been more or less epidemic for the past five years, it imposes a constant vigilance upon the sanitary condition of those coming from such countries. These emigrants are lacking, too, in even the ordinary habits of cleanliness which characterize those from the more western portions of Europe; wearing whole suits of leather, it may be for months in succession, the clothing becomes in an especial manner easily contaminated, and, when so, impossible to purify. The limits of a paper will not permit a recital of the practices which govern the inspection of these vessels, for it covers not only the prophylactic measures involved in the principle of quarantine, but also the general hygienic regulations which pertain to the comfort and well-being of the steerage passengers. Indeed, the functions of the

department are now extended to every thing which pertains to their hygienic condition ; so that while the community, on the one hand, is protected, the passengers are maintained as cleanly as the crowded quarters permit, and a system of aëration and a frequent sending on deck is enforced.

It may be asked, "Are not the ports from which these emigrants sail equally exposed as this port?" We answer, decidedly not ; they seldom receive from sea any of the passengers which they send to us under such crowded conditions. The emigrants reach those ports in small parties, by rail or otherwise, and it is only when a thousand to fifteen hundred are crowded in a limited space that the germs of contagious disease spread with such fearful violence. On land a single case may be promptly isolated ; not so, however, on shipboard. Isolation and sequestration are almost impossible, while all concomitant influences, such as confined air, filth, bilge-water and dirty clothing are so many fostering influences for the germ.

If the general principles we have expressed are correct, it will not be difficult to make the particular application, not only to any given locality, but also with reference to the particular disease it is desired to contravene. Such application must be founded upon the natural history, the manner of transmission, and the period of incubation of the disease, and, in shaping restrictive measures, all incidental circumstances must be borne in mind. Whenever rational hygienic measures are faithfully pursued, not only at the source of the infection ; but also on vessels in transit, it should be a powerful modifying element in the restrictions applied to passengers, cargo, or vessel on their arrival in port.

I have, however, so far transgressed your patience that I leave the subject, hoping, if agreeable to you, that I may, at some future time, elucidate this branch of the study.

ON THE
TRANSMISSIBILITY
OF
YELLOW FEVER AND CHOLERA
IN THEIR
RELATIONS TO QUARANTINE.

By S. OAKLEY VANDERPOEL, M.D.,
HEALTH OFFICER OF THE PORT OF NEW YORK.

On the transmissibility of Yellow Fever and Cholera in their relations to Quarantine.

By S. OAKLEY VANDERPOEL, M.D., Health Officer of the port of New York.

After the pretty full discussion of the principles which control the organization of quarantines, we can now advance to the study of the two principal diseases whose inroads they are expected to interrupt. The study will, of course, be limited to their origin and modes of transmission, and not in any way to their diagnosis, pathology, and treatment; the intent being that, by understanding the material features, an intelligent prophylactic course can be adopted. In the limited time allotted, this examination will be necessarily brief and cursory, and I shall, therefore, only attempt to present the salient points in yellow fever and cholera.

YELLOW FEVER.

Yellow fever is a transmissible disease, its place of origin being, probably, certain of the West India islands, and portions of the shores of the Gulf of Mexico. Its prominent characteristics are, a feeble condition, vomiting of black matters, hæmorrhages, and a yellow coloration of the skin, more or less constant, but which is usually most marked *after* death. The enumeration of symptoms indicates, at first sight, a general disease—an intoxication produced by a specific principle—which extends its action to the whole economy. It does not always present the same intensity. While usually assuming the severe form, we may have also merely outline or typical cases, which, to the sanitarian, are as much to be dreaded as the more decided. These half-sick often deceive the most rigid scrutiny; yet they possess the same specific element as the graver kind, and, in point of contagion, the same danger. Quite as much as the lighter forms of scarlet fever or small-pox convey the specific germ, so do these outlined cases of yellow fever.

It is not necessary, in this connection, to enumerate the epidemics of yellow fever, even along the different cities of the Atlantic coast. It has appeared as far north as Boston, nearly two hundred years since, followed by several outbreaks during the latter part of the eighteenth century; while, in New York, during the last century and the early years of the present, it was marked by several

epidemic appearances. It has become a yearly visitor at the port—not a summer passing but from twenty to sixty cases are treated at the quarantine hospitals.

Yellow fever can, so far as the greater part of the shores of the United States are concerned, be termed an *exotic disease*. When and where are the precise spots of its origin will probably never be known. It is never shown on our shores except by importation. Once introduced, it may develop and propagate, but never spontaneously. Limited as seems originally to have been the extent of territory from which it could claim origin, that territory has, through human intercourse, been very greatly extended, and there are now few places in the tropical and semi-tropical coasts of the Atlantic but what may be termed starting-points for the spread of the pestilence.

In this connection it should be noted that, while the disease has been known on the Atlantic coast for over two centuries, it is only within the past thirty years, or thereabouts, that its appearance has been established on the coast of the Pacific. This, in part, may be accounted for by the difficulty of transmitting it, even in the hold of the ship, around the cold and wintry climate of Cape Horn; but also by another principle scarcely less potent—the difference in the telluric aspect of the two coasts, the one offering conditions for a permanent *nidus*, the other wholly different. Much of the tropical and semi-tropical coast on the eastern shore of the continent is low, flat—through which large rivers pass slowly and sinuously—and is eminently unhealthy. The western slope, formed through most of its extent by the chain of Cordilleras, presents a far less favorable field for development.

The special sources from which the fever emanates are those marked by paludal conditions. An alluvial soil, scooped or argillaceous, inundated, periodically, by long rains; covered or bordered by mangroves; channels with mixed salt and fresh water; pools of brackish water, or lagoons, formed at the mouth of the tortuous, sluggish river; these, and other paludal conditions—such as exuberance of decaying vegetation, subsoil infiltration—mark the immediate spots from which the fever may propagate. Yet, even here, let me recall a remark made when speaking on the general subject of malaria: that, with its paludal origin, it is not necessary to suppose that there is an identity of cause between yellow fever and the forms of malarial disease. The two diseases have been repeatedly shown to exist simultaneously. The one is transmissible,

the other is not ; and, again, many countries, many localities exist which generate a deadly paludal but no yellow fever. We may say that the germ of yellow fever appears to be of an organic, miasmatic nature—whether vegetable or animal cannot be affirmed—coming from endemic localities. These localities are exclusively found either on the borders of the sea or at the mouths of rivers, often in common with paludal fevers proper, but still differing from the latter in power of transportation for great distances, and preserving for a long time, without alteration, its reproductive germ.

Recognizing, then, the telluric influence in the origin of yellow fever, there are certain local conditions which favor its propagation when transplanted. First, its ravages are chiefly confined to low countries. Dr. Tower, after a careful analysis of all the localities in which it has prevailed in this country, finds none as high as five hundred feet above tide-water. Again, density of population is another element ; it seldom assuming an epidemic form in localities containing less than five thousand inhabitants. Humidity of the soil also exercises an influence. Soil saturated with water will preserve the disease-germ. In this respect it presents a notable analogy to cholera. As with cholera, too, the social and hygienic conditions of a people exercise a notable influence in its propagation. It attains its greatest malignity among the filthy and impoverished, particularly if, as generally occurs, these reside in the low and ill-drained localities of any city.

A word should be said relative to the acclimation of individuals. The general impression is, that the residents of tropical latitudes are, to a great degree, exempt, its ravages being confined to strangers or those unacclimated. This is, however, the case only when the disease is endemic. Let it appear for the first time in any tropical regions, and natives are quite as liable to fall its victims as any other class. Acclimation, therefore, is only to those who have passed a preceding epidemic period, without having left the country, and who must have been more or less impregnated with the yellow-fever germ.

As the germ of yellow fever is, of necessity, transported from locality to locality chiefly by vessels, either engaged in commerce or war, it becomes, to the sanitarian, a question of the first importance to determine whether the fever can develop spontaneously upon the ship. If its spontaneity is possible, then sanitary measures and precautions should not be restricted to vessels coming from ports where the fever is known to exist, but to every vessel in bad

hygienic condition, traversing tropical regions. The opinion of physicians of extended experience is unanimous against the hypothesis of spontaneous generation. If it were possible, how is it that it never appears in vessels from China or India—vessels which, from the length of the voyage, and the long exposure to tropical heats, would seem to be in external conditions to favor the development?

While, therefore, the vessel may not create the specific cause, it may become a powerful agent for the concentration of the poison, independent, indeed, of the crew themselves. This power resides in the interior arrangements, in the stowage of the hold, in the material and character of the cargo. We frequently see, on shipboard, the disease re-appear if it has ceased, or become exasperated if already present, should some change be effected in the stowage, no matter in what part of the ship this occurs. This persistence of infectious causes on shipboard is so remarkable, that sometimes, after the unloading of the cargo, even for months, if the vessel is not thoroughly purified, every one entering the vessel is at once taken sick. While practically this cleansing on board of vessels engaged purely in commercial pursuits is easily and promptly effected, it becomes a very serious problem upon vessels-of-war. The more intricate construction of the latter, the difficulty of reaching the innermost parts of the vessels, render thorough purification almost impossible. Dr. Bell, of Brooklyn, for some years a medical officer in the Navy, has informed me that some of our vessels-of-war, once infected, could never enter a tropical region, no matter whether the disease existed at the particular point or not, but that the fever would re-appear on the vessel; that, too, although the vessel in the mean time had spent a year in cold latitudes, without showing the least suspicion that the fever-germs lurked on board. It is this tenacity of the poison to the ship, which induced the hypothesis of spontaneous generation. It would rather be a powerful consideration that there was a living, vital germ, of remarkable tenacity whenever a favorite *nidus* for lodgment was presented. It becomes magazined in the hold and sides of the vessels.

While to certain ports on this continent the question of transmission of yellow fever might, with some show of probability, be questioned, yet, when we have innumerable well-authenticated and observed instances of its transmission to European ports, and many of the more northern on this continent, it would seem that point

required no extended discussion, and it remains only for us to determine the modes and manner of the transmission.

Probably, in the literature of yellow fever, the features of no one epidemic have been more carefully studied, and the surrounding circumstances more carefully noted, than in that which occurred in St. Nazaire, France, in 1861. Situate entirely beyond the yellow-fever zone, in 40° of north latitude, there was no danger of confounding the disease, or mistaking the modes of transmission. Every circumstance was most carefully noted from the very inception of the epidemic, by an expert commissioner, on the part of the government. In the statements now made, therefore, many will be drawn from the study of that epidemic, without necessary allusion each time to the source. I may state that experience at this port, and all the other writings I have consulted, fully corroborate the statements advanced.

We have seen that the germ of yellow fever, having its initial point on the borders of the sea, or at the mouths of maritime rivers, in a comparatively restricted part of the equatorial regions, may leave these regions; during transit it may be its presence is manifested by the appearance of sickness among the crew; then, on the arrival of the vessel, we see, during and after its discharge, a series of accidents which, starting from a common source, go on to multiply, forming thus the starting point of the many epidemics of yellow fever. We must now examine closer into the mode of this transmission, to determine whether the vessel, the cargo, or the crew and passengers are the agents.

In the vessel the preponderating influence belongs to the *hold*; there is a confined atmosphere in which the morbid germ goes on concentrating, and which, when the hatchways are open, allows the disease to appear, destroying those who come within its influence, even at distances of several rods. Those necessarily most exposed are the stevedores, who work in the hold, unloading the cargo, and the coopers who repair the broken packages. The water of the bilge is also a favorite lodgment for the germ. If, in the purification of a vessel, this is overlooked, the disease, if once present, will almost certainly re-appear. Certain cargoes or articles will transmit the germ, but their influence is secondary to the *hold of the ship* itself, and are usually harmless unless the hold is already surcharged, so to speak, with poison. It may also be transported in the clothing of passengers and dunnage of sailors. It is not, however, directly contagious from person to person. In the five years that Dix

Island has been used as a hospital for this disease, not a case has ever appeared among the attendants or the residents of the island. Of course, precautionary means are taken, the details of which will be given when we speak of prophylactic measures. In this respect it stands in striking contrast to cholera. The one is transmitted by influences entirely outside the individual himself, the other by influences arising directly from the person affected. To apply botanical terms, the one is exogenous, the other endogenous.

The pernicious influence is exerted not only upon those who are immersed in the infected atmosphere, but the poison may be carried by currents of air for greater or lesser distances, and, if the exposure be sufficiently long, affects those thus subjected. It can be distinctly traced for over a thousand feet.

Some practical points remain for us still to determine: 1. The incubation—upon the decision of this must depend the length of quarantine observation. The result of many observations has fixed the duration between two and six days; most ordinarily *three* or *four* days.

Having considered the origin of yellow fever, the extent of territory in which it has been acclimated, the manner of its propagation, and the duration of incubation, we are prepared to consider the necessary prophylactic measures.

1. *Measures to be taken at the port at which the epidemic prevails.*—Directly, we have no control of measures to be applied there—indirectly, our influence is felt, for the facility afforded to those who employ proper precautions warrants them in following the suggestions given.

As filth is the almost necessary *nidus* for this, as well as all contagious germs, the utmost cleanliness on the part of the vessel, and the persons of the crew, should be enforced. While the vessel is in port the bilge should be pumped out daily, and often sea-water pumped in until the water pumped out is clear. After the men have finished their day's work, have them take a bath and put on clean flannels, and do not allow them to lie upon the open deck; wherever there is a poop-cabin so much the better. If the bodies are cleaned, and clean flannel used, all the animal effluvia and sweat which remain on the surface are got rid of; these are found to be a *nidus* for the germ. Still one more measure experience has told is beneficial. It has been found that sailors, whose bowels are kept a little active while in port, are less liable to take the fever, and, if they do, the attack is less severe.

2. *Transit of the vessel to this port.*—The hatches are to be kept open and the hold freely ventilated whenever the weather will permit. It is in confined air that the virulence of the poison is concentrated. The bilge-water should be daily changed. On arrival at port, the duration of the traverse is first noted. If no sickness has occurred, and the passage has occupied more than six days, the crews, after thoroughly airing their dunnage, and submitting it to fumigation, are discharged. It may be noted that the crews seldom take any part in unloading the vessel.

Careful inspection of the cleanliness, as far as can be, is made by the inspecting physician. The hatches and all possible openings are kept open for twenty-four hours in the lower bay, so that the strong air which usually prevails there shall permeate every part; everything is then closed tight, and fumigation, as thorough as can be, is made in all parts of the vessel. Arrived at the lighterage-station, the discharge is commenced at the earliest moment; there is absolutely no quarantine of detention; for, if there be fomites on board, the longer it is allowed to remain in the hold and bilge, the more virulent it becomes: a little leaven leavens the whole lump. Here, so far as the cargo is concerned, fresh air is wholly relied on. The raising of the cargo on deck in the open bay, passing it to the deck of an open lighter, where it lies several hours for free aëration, carrying it some miles across the bay to a warehouse, so diffuse any fomites, that, in the two summers' experience I have had, not a case of sickness has arisen from this source, and that, too, on very many vessels bringing sickness into port.

Fumigation is daily made upon the vessel during the unloading. This discharge of cargo is performed by stevedores, who remain at the lighterage station continuously, no one ever being allowed to go to the city for six days after he has labored upon a vessel. The same rule refers also to the coopers, for you will remember it was stated that the great danger consisted in going into the hold of an infected vessel during the time of her discharge. When the cargo is entirely removed, the sides, and every part accessible, are subjected to scrubbing with brooms and water, after which a more thorough disinfection and fumigation follow, and the vessel is at once furnished free *pratique*. She is thus actually returned to commerce sooner than if permitted to go to dock and be subject to the usual process of unloading. There is, therefore, so far as yellow fever is concerned, no antagonism between commerce and quarantine.

Should the vessel have sickness at the time of entering port, or

have had sickness or death on the passage, the vessel proper takes the same course: the sick are at once taken off, and the crew or passengers, instead of being at once discharged, subjected to surveillance until a period of five or six days from the last case shall have transpired.

The large use of steam transportation between this and yellow-fever ports modifies in some respects the foregoing regulations.

Reaching, as they readily can, this port within the period of incubation, I have established the rule that five days must elapse from their departure before any passengers or crew can leave ship. As this time is more patiently passed at sea than lying in the lower bay, the time of passage is usually made to fill the entire period. While five days is not the limit of incubation, I must depend somewhat upon the doctrine of averages; that is, if, in a hundred persons, passengers and crew, no case of fever is developed during that time, taking into account the possibility that with some it may have been in incubation at the time of their going on board, I conceive there would not be one chance in five hundred for it to develop on the sixth day. Passengers, if no sickness have occurred, are at once allowed entry to the city. Should there have been sickness, the course already indicated would be followed out. The steamer is lightered and subjected to the same process of cleansing as in a sailing vessel. It is readily understood that, with steamers, time is a far more important factor than with sailing vessels. With an average arrival of five or six weekly from yellow fever ports during the past summer, not one lost her sailing day. Here certainly was no antagonism to commerce. That our visits of inspection were not fruitless, sixty-two cases of yellow fever were taken from forty or more different ships during the past summer; that the protective measures were efficient, is shown in that not a case reached the city or came above the Narrows.

I must now pass to the consideration of the remaining exotic disease, viz., *cholera*. In its historical features it presents, taken in connection with the frequency of its later irruptions, an unusual interest, while various writers have attempted to show that cholera was recognized in the writings of Hippocrates, quoting, indeed, the passage from that writer which attempts to prove such recognition, but which points unmistakably to cholera-morbus, or, as termed by the French, cholera-nostras. True, between the two there is a symptomatic analogy which is not manifested in the clinical expression. The specific cause separates them both; the same as between a violent

indigestion provoked by indiscretion in food, and the phenomena determined by taking certain poisonous substances. There may be an apparent similitude, though no identity of cause.

If, however, we turn to the most ancient of the Eastern manuscripts, we have unmistakable descriptions of the terrible malady. The intermittent character of its virulence can also be recognized from the time of the first appearance of Europeans in that portion of the world. It was this intermittent character which caused so many years to elapse before its specific recognition. Following down the lapse of years after its recognition, its presence is, from time to time, signalized. Even during these three centuries, and while communication with Europe was constant, it maintained almost wholly its endemic character, being limited to the south-eastern portion of the Eastern Hemisphere. Nor was it until 1817 that it assumed its migratory character. From this time it presents the singular phenomenon of a disease suddenly changing its character, to emigrate from its birthplace and extend its ravages throughout the world—to be carried from the borders of the Ganges to the Elbe, and finally to reach the capitals of Europe in 1831, and this country in 1832.

The terror it has inspired, the frightful mortality following in its train, the repetition of its invasions, the almost well-grounded fear that it may become acclimated, explain sufficiently the interest which attaches to its study, and the multiplicity of writings of which it has been the subject. By universal assent, and a conviction derived from its non-recognition by earlier European writers, by its description in the most ancient of those of the East, by the study of successive irruptions during the present century, its origin is referred to the valleys of the Ganges and the Brahmapootra Rivers. Nor is the locality of its endemicity probably very extended. It may be described as general in the province of Bengal, and especially the city of Calcutta; with less intensity in the stations of Cawnpore and Allahabad, and their environs. In other countries of India which, in this respect, may be termed near, and in almost similar external conditions, it appears as epidemic, it may be yearly, as at Madras and places of Hindoo pilgrimage, or every four or five years in the provinces of Northwestern Hindostan. As in yellow fever, so in cholera, the exact nature of the particular circumstances which produce the choleraic germ has not been determined, nor why it should be found particularly in that valley. All the peculiarities, both from the formation of the river, and the

habits of the populations on its banks, have been mentioned, but without receiving the accreditation of dispassionate observers. We can only say, with probability, that it, too, like yellow fever, has a paludal origin, the mysterious germ of which, once introduced into the human system, may go on in the process of propagation, without any lessening of its contagiousness or virulence, even though it had traversed large portions of the earth's area, and had passed through millions of human beings.

Like yellow fever, its power of transmission has also been denied, and, when the epidemic ravages have spread over whole countries, general influences have been invoked to explain the ravages. With its more careful study, few, I think, will venture to deny, not only that it is transmissible, but also that it is *contagious*. In this, bear in mind the broad distinction between cholera and yellow fever. The latter has been stated as not strictly contagious, but transmissible through the media of many substances, and the confined air and bilge of vessels. The former is, however, directly contagious from person to person, and may be conveyed wherever there are routes of human intercourse, whether by land or sea. It is now, and has been for some time past, a favorite study to trace out the grand routes of the various epidemics which have, within the past forty years, so often scourged Europe and portions of this continent. We need here only refer to the results of those studies which have enunciated the principle of its transmission by the great routes of human travel. This, is, then, the central fact of the study, that it is transmissible and contagious from the sick to the healthy, not by contact with the bodies of the sick, but with a material poison thrown off from their bodies, and capable of being conveyed to a distance. This recognized, we start from a presentable stand-point, and feel an assurance in efforts to prevent the spread of the pestilence.

The question has often been raised, "Why is cholera only an occasional visitant beyond the limits of its endemic house in certain provinces of Bengal?" It has been supposed that some unknown atmospheric conditions favor the extension of the disease at certain seasons, and not at others. True, as a rule, it is favored by high temperature, and checked by cold. Still there have been serious local outbreaks, during the winter season, in India, Europe, and this country. Neither great moisture nor extreme dryness of air is essential for the prevalence of the disease, which has been widely diffused, and very virulent under the opposite extremes of moisture

and of dryness. The disease has sometimes been known to break out with sudden violence after the occurrence of a mist-laden or a dust-laden wind blowing from a neighboring infected district, and it has sometimes received a sudden check after the occurrence of a violent storm. Probably human occurrences explain, partially, this remittent character rather than the influences of telluric or physical agencies. (In studying the habits of the people it is found the outbreaks occur coincidently with certain great fairs and pilgrimages, when immense multitudes are brought in close relation, with all the accompaniments of filth, and utter lack of all sanitary precautions.)

The cholera shows itself every year with more or less intensity, in an epidemic form, in places where the pilgrims gather. Many of these combine both fairs and religious ceremonies. Among the principal places where this double purpose is carried out are Hurdwar and Juggernaut (and Conjeveram). Hurdwar is in the north of Hindostan, on the Ganges, just where the river breaks through the mountains. The fair is held there every year just at the full moon of April, and every twelve years the pilgrimage is reputed more efficacious than ordinarily, and consequently the affluence there at such times is enormous. A million of persons from every direction are gathered there to make their ablutions in the sacred waters. Passing the night upon the banks of the river, without any covering, they strive to enter the water as nearly as possible at the same time. Scarcely do the ceremonies commence than the disease breaks out, and twenty thousand have been known to die in eight days. Can we seek for a more efficacious mode of distribution? These pilgrims are not alone confined to Hindostan; but, over all countries where the Hindoo worship prevails, pilgrims come to these sacred shrines. They disperse to the northwest along the great caravan routes, carrying the pestilence in their train. A similar mode of distribution is recognized in the immense pilgrimages of Mohammedans to the sacred shrine of their prophet.

While, therefore, recognizing the original spot and district from which cholera may radiate in an epidemic form, as also the means through which this distribution has been chiefly made, the question naturally arises whether or no it may become temporarily endemic or acclimated in any district. The inquiry at this juncture becomes the more pertinent, since thus far the most diligent research has failed to trace the epidemic of the past season in the Mississippi valley to importation, and the chief medical officers of Russia have

made a similar declaration with reference to the severe epidemic in portions of that empire during the last summer.

THE ACCLIMATION OF DISEASE.

The solution of this question becomes of the highest interest, when we consider the important bearing it has with reference to the origin and portability of several cholera epidemics.

The first point of observation is, that neither yellow fever nor cholera becomes acclimated in every point, where, for a season, they may prevail epidemically. Yet, wherever they occur in a zone where the meteorological conditions and physical formation of the soil resemble their original starting-point, it is not improbable the germs may remain for periods latent, to re-appear in activity under some special conditions, the precise nature of which we are not, as yet, cognizant of. The facts illustrative of this, derived from yellow fever, are numerous and well established; those of cholera bearing upon it are now undergoing lively discussion by epidemiologists, both in Europe and this country. It is generally conceded that the starting-point, the *nidus* of country, so to speak, from which both diseases sprang, is comparatively limited; and yet we notice in the case of yellow fever that it is permanently endemic, in a large portion of the tropical and sub-tropical regions of the Atlantic coast.

It is a strange fact that yellow fever is older at all the northern ports of this coast than at New Orleans. Its first appearance in that city was in 1796, since which it has prevailed epidemically there thirty-five times, while not a season passes in which it is not more or less endemic. It appeared in Boston a hundred years previous to that date, nearly the same in New York and Philadelphia, and in Charleston ten times before its appearance in New Orleans. This seems the more remarkable, that, while it was so frequently epidemic upon all the chief cities of the Atlantic seaboard, New Orleans was more closely connected in geographical position, commercial intercourse, language, and government with both insular and Central America, where yellow fever had prevailed for centuries. Several other places in that zone could be specified, where similar conditions are shown to exist: so much so, that we cannot always locate the precise point from which an epidemic may spread. It is difficult to assert the same with reference to cholera. Its appearance is relatively far more recent; its birth-place so restricted, its usual course through the medium of pilgrims so apparent, that epidemiologists have become accustomed

to that source, and that alone, for the origin of every epidemic; and yet within the past year epidemics quite wide-spread have appeared, both in Russia and in this country, where the most diligent inquiry thus far has failed to trace the direct importation of the disease; and how would it be strange or strained if the analogy of yellow fever were applied to cholera? Both diseases have a paludal origin, both are transported by what we must term, in our present state of knowledge, a *germ*, for the transmissible principle in both shows so many of the properties of animal and vegetable germs, we can relate it in no other connection. Now, all analogous forms of life readily propagate themselves whenever a suitable *nidus* is presented, even far from their primitive origin, flourish for a season, pass into a period of quiescence, to re-appear again after a season in all their first activity. The period of this dormant vitality is not known, and is it difficult to conceive of cholera what is now fully recognized of yellow fever? In the late cholera epidemic in Russia there was an interval of two years, 1867 to 1869, when it would seem to have been latent, and to have re-appeared without the importation of any new germ; and Dr. Blikan, as Director of the Medical Department of the Russian Government, says of the epidemic of the last season, that, "the infected localities being separated from each other by an immense space, entirely free from cholera, the idea of any genetic connection between the epidemics which visited these localities, falls of itself to the ground."

You are all aware of the wide-spread epidemic which has prevailed during the past summer in the Mississippi Valley. Starting in April in New Orleans, it pursued its usual course of propagation to all the principal towns along that river, varying in intensity in almost every instance with the cleanliness of the place, and the vigor of the local hygienic measures adopted to suppress it. Now, the most diligent, painstaking research has so far failed to trace it to importation. The heretofore recognized necessity for such an introduction left no stone unturned to establish it in this instance. The local sanitary authorities of that city, early impressed with the necessity of deciding the inquiry, have failed to find even the most distant trace of importation. The chairman of the State Board of Health of Louisiana gave the subject his earnest and prolonged research; the physician to the lazaretto at New Orleans affirms that he examined every vessel bringing passengers from European ports during the months of January, February, and March, that not a death occurred upon the passage, and not a case of diarrhoea

was noticed. So far the universal negative testimony, of those whose duty would be to know, is entirely opposed to importation, and we are compelled to accept their report until a positive relation can be established. I might add, incidentally, that many of the telluric and meteorological conditions of the lower Mississippi resemble the Ganges, and that it would be difficult at least to suppose that the same dormant condition of the germ known to exist at the Ganges may occur at the delta of the Mississippi. If cholera be propagated by a germ, would there be a radical difference between that and all other germs? And yet, who has ever supposed that the germ, infection, or whatever it is called, of small-pox, became any the less active, much less lost its vitality, because it did not always prevail in an epidemic form; or, again, who ever failed to see the characteristic pustule of the vaccine, even though it had passed through hundreds since its renewal? You readily see, gentlemen, the solution of this question has an important practical bearing. If the doctrine of even *quasi*-acclimation be accepted, we must look even more closely than we have done heretofore to the fulfillment of all local hygienic measures.

Do not misapprehend me; this is no effort to show that cholera may spring *de novo*, wherever the external conditions of fomites and filth are favorable to its development; it recognizes the vital, living germ—the germ, which, when active, produces cholera and nothing else; still a germ which, when it has found its appropriate *nidus*, may remain for a season quiescent, until seasons and conditions conspire to have it display its full power as an epidemic.

Perhaps it may be suggested here that the acclimation of yellow fever is admitted, but not so with regard to cholera, since the germ of each is transmissible in different ways. The germ of yellow fever not being generated in the human system, nor transmitted from person to person in any way, but generated *outside*, and taken up after the manner of marsh-malaria, easily finds its acclimation in the many articles in which it is transported, but that cholera-germ, generated in the individual, could only be transmissible by the actual presence of those suffering from it. This, it seems to me, is the strongest point of the argument against acclimation. Yet who will decide the length of time during which the cholera-germ may retain vitality when in a favorable *nidus*? Who will determine the length of time that the trichinæ or the tape-worm may continue in the cestoid state unless favorable influences for their development occur? The little animalcules which swarm

each mud-pool are, as the pool dries up carried off with the floating wind, to re-appear in full activity at the next summer's shower. The epidemic in Russia has shown that the germ remained vitalized for two years at least; how long would this continue under the more favorable influence of a tropical clime?

Dr. Macnamara states that if fresh cholera *dejecta* are dried on clothes and furniture, or in the soil, they retain their activity for years, if access of moisture be prevented. He had some of the *dejecta* which, when fresh, were mixed with sand and dried seven years before. Now, when mixed with water, and exposed to the sun, they could not be distinguished from a fresh cholera-stool.

Having established that cholera can be transmitted, it remains to show how this occurs, what are the agents of transmission, how it is influenced by the different modes of locomotion, the crowding of persons, what are the attributes of the generating principle, the means by which it enters the organism. In the limited time remaining, these can be treated only in the most general manner:

I. This contagion always follows the routes of travel, and never progresses faster than it can be transported by an individual himself. In this is, of course, included all that pertains to his progress; his baggage, merchandise, the vessel which carries him, everything indeed which accompanies him.

II. The poison of cholera is cast off with the characteristic discharges of the alimentary canal, and communicated to others in the following principal ways:

1. By the soiled hands of the attendants who are not careful to wash before taking their food.

2. By means of bed and body linen, carpets and other articles soiled by the choleraic discharges.

III. The discharges finding their way into the sewers and into the soil may spread the disease in various ways: 1. By percolating through the soil into wells and other reservoirs of drinking water. 2. By rising with watery vapor into the air. 3. By becoming dried, and then dispersed with the atmosphere in form of an impalpable dust; or, in the words of Mr. Sirnon, Registrar-General of England, "it cannot be too distinctly understood that the person who contracts cholera in this country is, *ipse facto*, demonstrated with almost absolute certainty to have been exposed to excremental pollution, excrement-sodden earth, excrement-reeking air, excrement-tainted water."

Nor is it essential for this contamination that the infected person

should be laboring under the full access of cholera-symptoms. The affection is just as certainly transmitted, and probably more frequently by persons suffering from mere choleraic diarrhœa. The essential germ is the same in both, and the choleraic diarrhœa of one will develop into the malignant form in another. Whenever it passes by a sudden leap from an affected locality to one not as yet poisoned, it is probably by some such transportation. Persons so affected are moving about—it may be traveling in cars or on river steamboats. Each dejection, miles separate, may disseminate the poison in the particular locality. Numerous authenticated cases are on record of propagation in this manner, and, during the epidemic of the past summer in the Mississippi Valley, its capricious meanderings were many times traced by this mode of transmission. Its importation to this country is, of necessity, by ships, and, as by far the greater portion of people enter this port, the danger from this source is relatively greater here than in any other. To show the activity it acquires, after being retained for a time on board, let me recite the following fact: The steamship *England* arrived off Halifax a few years since with cholera on board. A pilot, with an assistant and his son, went off to the ship in an open boat. Hearing that there was sickness on board, the men remained in the boat, which was towed at a considerable distance astern by a ten-fathom line. In this way the ship, with the boat in tow, was conducted to her place of anchor. The pilots then went on shore, and were never on board the infected ship. In the course of the next two days both men were seized with cholera, and one died. Both men communicated the disease to their families. In the family of one there were three cases, but no death; in that of the other, besides the father, who died, there were four cases and two deaths. The only other cases of cholera in Halifax at that time occurred in the family of a man, whose two children were seized, after playing with soiled bedding which had floated on shore from the infected steamer; one child died, the other recovered. The mother also took the disease and died. Surely if disease was ever communicated by infection, it was so in the case of these three families, the different members of which were, in various ways, brought into contact with the infecting material imported by the steamer.

An indirect proof of the contagionsness of cholera is afforded by the fact that the disease has never reached certain countries which, being separated from India by a wide expanse of ocean, and having little communication with that country, have escaped the infection.

Among the countries are Australia, New Zealand, and the other Pacific islands ; the Cape of Good Hope, and the southern part of the west coast of Africa ; the Azores, Bermuda, Iceland, the Faroe, Orkney and Shetland islands, and the western coast of South America.

Of the agents for the immediate transmission of cholera, *impure water* plays an important part. Whoever has kept pace with the many writings on cholera, will see the importance which of late years has been attributed to impure water as an excitant of cholera, not only on the general principle that water, rendered impure by the presence of large quantities of organic matter, favors the spread of an epidemic, but also from water contaminated directly by cholera excretion. Now that public attention is fully awakened to this matter, and also the fact that, almost for the first time in this country, the epidemic of the past summer was carefully noted in many places, we have many interesting proofs establishing this source of poisoning. In the first case which occurred in Lexington, Kentucky, the dejections were thrown out, so that by percolation they reached a well situate near by ; twelve subsequent cases were clearly traced to this water contamination. In this connection, I can as advantageously notice as elsewhere, that out of a certain number of persons who are exposed to cholera contagion, whether by impure water, contact with excretions in any form, but a moderate percentage really suffer from such exposure : thus out of nineteen persons known to have drank inadvertently of water, in which cholera excretion had been thrown, but *five* suffered from the disease. Observations show that in a crowded community, apparently equally exposed to the same influences, the above figures are not far from the average, of those who will show actively the contamination. It happens, then, that a large majority of persons exposed to cholera-poison escape completely, or incompletely, though of the latter there are far more than of complete immunity. Of this category are the great number of choleraic diarrhœas known to prevail at the time of an epidemic. This immunity may extend to entire communities, for, after the recent presence of an epidemic, there is an indisposition for another, even though there may have been an entirely new importation ; a condition somewhat similar to what we noticed in yellow fever—the community is for the time acclimated.

Let me return, however. Another fruitful mode of contamination is from soiled clothing. Again and again has it been carried

into perfectly healthy districts by sending into such localities clothing which had been soiled by those suffering from the disease. Those, too, who wash such clothing are peculiarly exposed; indeed, it should be an established axiom that no contaminated clothing be washed until it has first been thoroughly immersed in some disinfecting fluid. Here, too, I may notice a clinical fact which is of practical value. There is good reason to believe that the fresh cholera-stools are nearly if not quite harmless; that their greatest infecting power coincides with the stage of commencing decomposition, and that in a more advanced stage of decomposition they again become harmless. The practical deduction is obvious: that attendants may, almost with impunity, wait upon those affected if the dejections are immediately thrown in some disinfecting composition, and care is taken to wash the hands and promptly remove soiled clothing. In addition to these direct modes of communication, the virus may be diffused through *the air*, and thus enter the system by the lungs. Its rapid dissemination in a locality attacked, the simultaneousness of a great number of cases in a given agglomeration of persons where contact has not been possible, the fact that persons may be attacked at a short distance from the suffering case, favor the proposition, and attest to the volatility of the cholera-germ. The distance to which the principle can be, in this way, transported, is probably limited, but still must be recognized in studying the active modes of propagation.

Pettenkofer, who has given to the subject long and patient study, insists that soil-saturation performs also an important part in this propagation; *i. e.*, that a porous soil, easily permeable to air and water, coinciding with an elevated water-level from subterranean springs, and especially coinciding with changes in the level of these waters, becomes an active agent in disengaging the poison once brought to it.

We have now no difficulty in understanding that cholera is a disease capable of being rapidly communicated from the sick to the healthy over an extensive population, and yet that, with ordinary precautions, the immediate personal attendants on the sick incur scarcely any risk of infection. In this respect, there is a very close resemblance between cholera and typhoid or enteric fever. The alimentary canal is in both diseases the chief if not the sole outlet for the poison. The bowel-discharges are the means for the infection, and, whereas, the fresh secretions are comparatively innocuous, the subsequent fermentation of the discharges from a

single patient may infect the drains of an entire district. Hence, it follows that the inhabitants of a house with untrapped drains, half a mile or more away, may incur three times more risk of infection than the sick man's nurse or doctor.

Having established the proposition that cholera can be transported, and pointed out some of the principal modes by which it is transmitted, it remains, in order to complete the picture, to fix the *duration* of the *incubation*, for cholera, like all contagious diseases, requires a certain time after its introduction into the system to develop its specific character. The congress of 1865 at Constantinople discussed this point long and fully; for the fact that the period of incubation may be from a few hours to (as many asserted) several days, necessarily called forth the most varied opinions. It is probable some of this diversity would be reconciled if the choleraic diarrhœa, which so often precedes the more intense symptoms, could be more rigidly determined. In the practical operations of the quarantine, we cannot, from its greater facility of transmission, take the average incubation, as in yellow fever, but rather extend it beyond the extreme period, say *ten* days.

It now remains to deduce the preventive measures, based upon these views of its history and modes of transmission. Our remarks will apply only to those applicable to its ingress by way of the sea. First, then, no arbitrary rules can be laid down which shall be applicable to all vessels. Every arrival of a vessel with cholera must, having in view all the general laws we have laid down, be judged by the particular features which belong to that case. While, as a rule, every vessel, its passengers and crew having had cholera upon its passage, or at the time of its entry, should be subjected at least to a quarantine of observation, still this rule is not without exceptions. For instance, two steamers entered the harbor last fall, having had deaths from cholera, and another with one well marked, and several of choleraic diarrhœa on board, neither one of which was detained more than twenty-four hours; and yet I felt quite secure in allowing them to proceed to the city. Why was this? In the first, the case was a cabin-passenger. The nature of the disease was almost immediately detected by the surgeon. At once absolute isolation was enforced, passengers from neighboring state-rooms were removed, dejections disinfected, and care taken with reference to soiled linen. Seven days had elapsed since the death; when the vessel entered, the state-room had been scrupulously cleaned and disinfected daily. Here, then, every intelli-

gent preventive measure had been employed ; the time of incubation, when any passenger having contracted the disease before entering the vessel, was past, and, in view of the measures employed, I had only to consider the possibility of contamination from the particular case. It had been limited to one ; the average time of incubation was more than past since his death, without another case, and I therefore decided to let the vessel go up. Now, had a cast-iron rigidity been followed, without reference to the measures which the surgeon employed, all the passengers should have been taken from the ship, subjected for eight or ten days to a quarantine of observation, the vessel itself thoroughly cleaned, and every part aired and daily fumigated. While such a course would have been warranted by law, and sanctioned, too, by sanitarians, I felt that the precautionary measures adopted were sufficient, and would encourage medical officers and the shipping interest to attack the disease at its *source*, rather than passively allow it to gain full headway, under the conviction that no efforts they might apply would be recognized by the sanitary authorities of the port.

The other death was in the steerage, so sudden that the surgeon was not informed until actual collapse. On inquiry, no dejection had taken place except at the water-closet into the sea ; none occurred after the collapse ; the clothing was, at the time, examined to see whether any stain was upon it ; the body was at once thrown overboard, all the effects disinfected, and ten days had elapsed since the death, on their arrival. Wherein would a quarantine of observation have helped me in this matter ?

In the case of cholera which entered the port, every precautionary measure had been adopted ; the most rigid examination and inquiry could not detect other cases of choleraic diarrhœa than those referred to. The period of incubation, from acquiring it before entering the ship, had passed, and, with no evidence of contamination to others, the vessel was allowed *pratique*.

In acting in this manner in the above three instances, I but followed, on a limited scale, what is universally recognized by all the European governments, and to which all their later efforts have principally tended, viz., to suppress the disease as far as possible at its source. They feel that the great field for precautionary measures is in the home of the disease, and the local governments are, as far as possible, discouraging the great pilgrimages, with the large agglomerations of people, and their subsequent religious rites, with already an appreciable diminution in the routes of transmission.

A vessel arriving, however, with several cases on board would be compelled to undergo the full ordeal of precautionary measures. The passengers would be removed from the vessel, subjected to a quarantine of observation; any sick appearing to be promptly removed to the hospital located on another island, a mile distant from the island where the quarantine of observation was enforced. In the meantime all clothing would be thoroughly washed, aired, and disinfected, and, when eight days had elapsed without the appearance of a new case, they would be allowed to leave. In the meantime the vessel, after being subjected to thorough cleansing and disinfection, would be allowed *pratique*.

I think you will agree with me, gentlemen, that in the restrictive measures there is no blind formalism, nor any mysterious proceedings. All are deducible from the accepted notions of the history, nature, and modes of transmission of the disease. If this principle is faithfully carried out, there will be, I am sure, no antagonism between sanitary and commercial interests, but most of the measures adopted in behalf of the one will indirectly promote the prosperity of the other.



